Pemanfaatan Limbah Cangkang Sawit untuk Sintesis dan Karakterisasi Arang Aktif Sebagai Bahan Penyerap Logam Berat pada Limbah Cair = Utilization of Palm Kernel Shells Waste for Synthesis and Characterization of Activated Charcoal as Heavy Metal Adsorbing Material in Liquid Waste

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Abstrak

Pemanfaatan karbon aktif dari cangkang sawit sebagai bahan penyerap logam berat pada limbah cair telah dilakukan. Pembuatan karbon aktif disiapkan melalui proses dehidrasi, karbonisasi, dan aktivasi. Proses dehidrasi dilakukan dengan pemanasan pada temperatur 120 , proses karbonisasi dilakukan selama 1 jam melalui pemanasan dengan variasi temperatur 400, 600, and 800 dengan rendemen arang yang diperoleh pada setiap temperatur yaitu 50.13, 45.66, dan 32.82%. Proses aktivasi dilakukan selama 2 jam pengadukan dan didiamkan selama 24 jam. Proses ini menggunakan aktivator KOH 10%. Distribusi ukuran partikel rata-rata untuk setiap variasi temperatur diperoleh ~39.78, 30.07, dan 12.99 m. Pola difraksi XRD menunjukkan karbon aktif cangkang sawit memiliki stuktur amorf, dan pada pola XRD dapat dilihat terbentuknya kristal pada sudut 2 sebesar 22.37%, 22.78%, dan 22.84%. Berdasarkan spektrum FTIR menunjukkan adanya pola serapan karbon aktif spesifik untuk gugus fungsi O-H, C-H, C=C, C-O dan C=O yang masing-masing menunjukkan puncak pada 3.691; 3.620; 2.920; 2.842; 2.382; 2.358; 2.355; 2.052; 1.534; 1.453; 1.052; dan 1.032 cm-1 yang menjadi sidik jari gugus fungsi untuk karbon aktif. Analisa stabilitas termal menunjukkan proses pengurangan massa seiring meningkatnya temperatur. Proses pengujian efektifitas penyerapan dilakukan menggunakan limbah sintesis yang mengandung PbCl2 1% dengan variasi waktu kontak karbon aktif ke dalam limbah cair terdiri dari 1 jam, 2 jam, dan 3 jam untuk setiap sampel. Konsentrasi limbah cair PbCl2 yang diperoleh setelah pengujian penyerapan oleh karbon aktif yang di cek menggunakan Atomic Absorption Spectroscopy (AAS) untuk setiap variasi temperatur dan waktu kontak yaitu pada suhu 400 diperoleh persentase penyisihan 1.2%, 2.5%, 4.4%, pada suhu 600 diperoleh persentase penyisihan 7.5%, 12%, 14.4%, pada suhu 800 diperoleh persentase penyisihan 15%, 22.15%, dan 27.5%. Hasil Scanning Electron Microscpy (SEM) menunjukkan sifat morfologi permukaan karbon aktif untuk setiap sampel, terbentuknya pori-pori yang semakin besar seiring meningkatnya temperatur dan setelah diaktivasi.
.....Utilization of activated carbon from palm kernel shells as a heavy metal adsorbent in liquid waste has been carried out. Activated carbon was prepared through a process of dehydration, carbonization, and activation. The dehydration process was carried out by heating at 120 , the carbonization process was carried out for 1 hour through heating with temperature variations of 400, 600, and 800 with the yield of charcoal obtained at each temperature, namely 50.13, 45.66, and 32.82%. The activation process was carried out for 2 hours of stirring and allowed to stand for 24 hours. This activation process uses 10% KOH activator. The mean particle size distribution for each temperature variation was obtained at ~39.78, 30.07, and 12.99 m. The XRD diffraction pattern showed that the palm kernel shells activated carbon had an amorphous structure, and the XRD pattern showed the formation of crystals at 2 angles at 22.37%, 22.78%, and 22.84%. Based on the FTIR spectrum, there is a specific active carbon adsorption pattern for the O-H, C-H, C=C, C-O and C=O functional groups, each of which showed a peak at 3,691; 3,620; 2,920; 2,842; 2,382;

2,358; 2,355; 2,052; 1534; 1,453; 1,052; and 1,032 cm-1 which is the fingerprint of the functional group for activated carbon. Thermal stability analysis showed the process of mass reduction with increasing temperature. The process of testing the effectiveness of adsorption was carried out using synthetic waste containing 1% PbCl2 with variations in the contact time of activated carbon into liquid waste consisting of 1 hour, 2 hours, and 3 hours for each sample. The concentration of PbCl2 wastewater obtained after the adsorption test by activated carbon was checked using Atomic Absorption Spectroscopy (AAS) for each variation of temperature and contact time, namely at a temperature of 400 , the percentage removal was 1.2%, 2.5%, 4.4%, at a temperature of 600 . the percentages of removal were 7.5%, 12%, 14.4%, at a temperature of 800 the percentages of removal were 15%, 22.15%, and 27.5%. Scanning Electron Microscopy (SEM) results showed the morphological properties of the activated carbon surface for each sample, the formation of larger pores with increasing temperature, and after activation.